FLUID FLOW CONNECTOR

This invention relates to fittings for attachment to membranes of the kind used to fabricate inflatable structures, for example temporary water tanks, boats and bathing aids.

Such fittings, usually fall into two categories: firstly those designated to a single function, for example a pressure relief valve, which is normally non-removably fitted during the manufacture of the structure of which the membrane forms a part, by clamping, bonding or welding and which are intended to remain as part of the product throughout its useful life. Secondly, fittings including threaded flanges can be used which are clamped, bonded or welded to the membrane into which an adapter or connector can be attached and which is subsequently removable from the membrane for service or maintenance purposes.

A problem arises with known fittings of the first type mentioned above in that they have to be fitted to the membrane in the early stages of the manufacturing process and can then be difficult to service. This can lead to the replacement of a whole structure to which the fitting is connected, if the fitting fails. A further problem associated with fittings of the first type is that there may be a compromise between the material requirements of the relief valve, for example and the compatibility required to attach the fitting to the structure's membrane. Known fittings of the above mentioned second type can be vulnerable to the adaptor being unsecured or removed while the structure is in use, leading in some circumstances, to a potentially dangerous escape of fluid contained within the structure. Furthermore, fittings of this type, and the adaptors for connection thereto, can be expensive to manufacture because of the close tolerances

necessary for the threads in both of the components to cooperate accurately.

The object of the invention is to overcome, or at least minimise, the problems associated with the known fittings of the first and second type set out above.

According to the invention there is provided a fitting for attachment to a membrane, said fitting comprising a mounting adaptor to be secured to such membrane, a resiliently deformable part associated with said mounting adaptor and arranged to embrace and hold an initially separate insert, said resiliently deformable part being arranged such that when the mounting adaptor is secured to said member and exposed to a force of a fluid exerted by fluid at one of two sides of the membrane, the resiliently deformable part is urged into gripping engagement with the insert.

The fitting for attachment to a membrane forming part of a structure comprises a mounting adaptor to be secured to such membrane and being provided with a resiliently deformable part arranged to embrace and hold an initially separate insert, said resiliently deformable part being arranged, such that when the mounting adaptor is secured to said structure it is exposed to a force of a fluid held within the structure urging the mounting adaptor into gripping engagement with the insert.

This arrangement enables different types of inserts to be used with the mounting adaptor and the insert which is fitted to a mounting can be replaced with an insert of the same type or a different type if necessary.

Thus, it is intended that the insert will take the form of the functional part of the fitting.

Preferably, the mounting adaptor is arranged to be secured in an aperture

formed in the membrane of the structure, the said resiliently deformable part of said mounting adaptor projecting into the interior of the structure so that, in use, it can be exposed to the pressure of air or gas or liquid held within the interior of the structure.

The mounting adaptor preferably has a flange arranged to be secured to the membrane of the structure. The flange may be formed from a weldable material whereby it may be welded to the membrane of the structure, for example if the device is to be made from a plastics or plastics-coated material. Preferably, the flange is provided with an annular channel for holding a rigid ring. More preferably, the flange is provided with two annular weld areas either side of said channel. Preferably, the flange is provided with an annular lip for locating the mounting adaptor within an aperture of said membrane and which upon melting welds the edges of the aperture to the mounting adaptor. Preferably, the lip is bonded to the flange.

The insert is preferably cylindrical and the central part of the mounting has the form of a correspondingly shaped sleeve. An axial end of the sleeve is preferably joined by a radially extending web to an outer cylindrical part which is in turn joined to the flange. In use, the sleeve is flexibly connected to the outer cylindrical part at the axial end furthest from the membrane. Preferably, said sleeve makes contact with the fluid in the structure.

The central part of the mounting preferably has a circumferential recess which receives the insert. The insert is preferably hollow so that it provides a fluid flow conduit or can be constructed as a functional device such as, for example, a valve or a support means for the structure. A support means may have, for example, one or more suction pads to enable the structure to be affixed to a surface.

Preferably the fitting can be formed from an elastomeric material and may be formed by injection moulding. The fitting can be attached to the membrane by welding, for example radio frequency, ultrasonic, laser or direct thermal welding, or in any other way such as for example, by adhesive bonding using a suitable adhesive.

In a further aspect of the invention, two or more fittings maybe connected by enclosed structures attached between the fittings providing a flow path for the fluid held within the structures. Two or more separate structures having fittings can therefore be connected in this manner.

The invention will now be described by way of example only and with reference to the accompanying drawings, in which:-

FIGURE 1d is a perspective view, partly cut-away, of a preferred form of fitting embodying the invention. Figure 1d shows a plain insert mounted in the fitting. FIGURES 1a, 1b (partly cut-away) and 1c show three alternate forms of insert which may also be fitted,

FIGURE 2 shows fittings in accordance with the present invention being used to join adjacent membranes of adjacent structures.

Referring now to the figures, FIGURE 1d of the drawings shows a fitting according to the invention comprising a mounting in the form of a housing 1 adapted for attachment to an inflatable air bag or other structure and a plain insert 2 fitted in the housing. The structure may for example be a structure for holding water. Alternate forms of insert 2 are illustrated in FIGURES 1a, 1b and 1c. Preferably the

housing and the insert are formed from moulded plastics material but of course it will be understood that these structures can be formed from any suitable material as desired or as appropriate.

The housing 1 comprises a flange 4 which extends around a central part 5. The flange 4 has an inner face 4a which is intended to be welded to an inside portion of the wall of a structure surrounding a circular hole in the structure through which the central part extends to the exterior of the structure, the wall of the structure being made of a flexible impermeable material such as a plastics material or a plastics coated fabric of, for example, "Nylon".

The flange 4 is shaped to form between its inner and outer edges an inwardly projecting annular channel 6 for accommodating a reinforcing ring (not shown). The reinforcing ring assists in ensuring that the housing is not distorted by stress caused by the pressure of the inflatable structure and therefore ensures correct positioning of the housing to the membrane of the inflatable structure. The provision of the channel 6 also creates two narrow annular weld areas at opposite sides of the channel 6. The use of two annular weld areas either side of said channel add security to the connection of the fitting to the material and the said areas together provide a greater spread of any load applied to the weld into a maximum area of the fabric of the structure. The provision of the annular channel 6, also enables a pressure test to be carried out on the welds of the housing 1 by providing a position to pressure test the joint between the flange and membrane of the structure.

Adjacent to the inner edge of the flange 4, where it is joined to the central part 5, there is formed an outwardly directed annular lip 7. This lip 7 serves to locate and,

by melting when welded, seals the edge of the circular hole in the membrane of the structure through which the central part 5 extends.

The central part 5 of the housing 1 is generally U-shaped in section to provide an outer cylindrical part 5a flexibly connected by a radial web 5b to an inner sleeve-like cylindrical part 5c. Outer cylindrical part 5a is rigid with respect to the inner cylindrical part 5c which is a resiliently deformable part. Part 5c projects into the interior of the fluid filled structure. The outer part 5a is thicker than the inner part 5c and of the flange 4 and is preferably of tapering form in section so that it maximises the connector's tolerance to distortion and resists crushing of the connector. A crush ring can also be provided which is attached to the outer cylindrical part 5a and which acts to increase the resistance to any crushing of the connector.

Parts 5b and 5c act together to seal the fitting so as to prevent fluid ingress or egress from the structure. Furthermore, when formed from an elastomeric material, the parts 5b and 5c assist in providing a positive engagement and security of engagement between the insert 2 and the housing.

The insert 2 comprises a cylindrical portion 2a which has an external diameter substantially the same as the internal diameter of the inner part 5c of the housing 1 so that it is embraced by the latter. The portion 2a is formed externally with two spaced circumferential ribs 8, 9, one at the inner end of the portion and the other at a spacing from the outer end of the portion. These ribs form an external circumferential recess 10 which receives the circumferential part 5c of the housing, the ribs engaging opposite ends of the circumferential part to hold the insert in the housing. The insert is a snap-in fit in the housing, said part 5c being resiliently deformed as the insert is pushed into

the housing. Sealing points SP between the insert 2 and the housing 1 are formed at each end of inner sleeve-like cylindrical part 5c by the action of part 5c resiliently gripping the recess 10.

The arrangement of the recess 10 and the circumferential part 5c of the housing enable the insert to be fitted the other way round in the housing. For example, if the valve contained in the insert is a one-way valve it can be fitted so that it permits fluid to flow into or out of the structure.

The arrangement of the thinner section cylindrical part 5c of the housing, which is resiliently deformable, and its connection to the thicker part 5a by the thin section part 5b allows the housing and the insert to move independently of one another. Also, the central part 5 of the housing is exposed to the pressure of the fluid in the structure so that it is urged into gripping engagement with the insert. Moreover the grip exerted by the central part on the insert increases as the fluid pressure in the structure increases. This enhances the seal between the housing and the insert and allows a relatively soft plastics compound to be used for the housing, which makes insertion and removal of the insert into and from the housing easier. The insert is also held more securely in the housing when the structure is pressurised.

The plastics material from which the housing is made will be chosen to be compatible with the material of the structure to which it is to be welded or otherwise attached. The connector material can be of any material chosen to be compatible with its function.

A valve provided in the insert may take various forms. Two examples are shown in FIGURES 1a and 1b.

In the valve in FIGURE 1a, the insert 2 is formed internally with an inwardly projecting valve seat 11 having an inner face arranged to cooperate with a circular valve member 12. This valve member is attached by a screw 13 to a tapered coil spring 14 the inner end of which bears against an outer face of the valve seat 11 so that the valve member is normally urged by the spring into engagement with the inner face of the valve seat.

This valve acts as a pressure relief valve.

The valve in FIGURE 1b comprises a resilient valve member 16 having a central stem 17 which is held in an aperture formed in a crosspiece 18 moulded integrally with the insert 2. This valve is normally used to provide means of inflation and deflation of an inflatable structure whilst providing an air-tight seal in normal use.

A further form of an insert 2 is shown in FIGURE 1c. It shows an insert having a means 20 for attaching an inflation tube 21 to the insert. Means 20 can thus be inserted into the tube 21 to provide a connection to the insert 2. The free end of the tube can then be connected to a pump and the inflatable body to which the inset is attached can be deflated or inflated accordingly.

In FIGURE 2 it is shown that one, or more, fittings according to the invention can be mounted so as to link together adjacent membranes by extending the fittings through adjacent apertures in the respective membrane of adjacent containers. In this way more than one structure can be connected using the fitting of the invention. The same numerals used in FIGURES 1a, 1b, 1c and 1d are also used in FIGURE 2 when referring to the same features. An alternative form of insert 2 having a weldable flange 30 is shown welded to a membrane wall A of a container. Flange 4 of housing 1 is

welded to membrane wall B of an adjacent container. Insert 2 can be fitted into the housing 1, thereby enabling fluid and mechanical connections between adjacent containers.

It is of course to be understood that the invention is not to be restricted to the details of the above embodiments which have been described by way of example only.